What is claimed:

1. A direct-write micro- or nano-lithography method for depositing a functional material with a preferred orientation onto a target surface, said method comprising:

(1) forming a precursor fluid to said functional material, said fluid containing a liquid component;

(2) operating a sub-micrometer tip to discharge said precursor fluid onto said target surface, by bringing said tip to contact said surface, so as to produce a desired pattern of deposited functional material in sub-micrometer dimensions; and

(3) during said pattern-producing step, subjecting the deposited material to a highly localized electric or magnetic field for attaining a preferred orientation in at least a portion of said functional material.

2. The method of claim **1**, wherein said precursor fluid comprises a compound selected from one of the following groups: (a) Compounds of the formula R_1SH, R_1SSR_2, R_1SR_2, R_1SO_2H, $(R_1)_3P$, R_1NC, R_1CN, $(R_1)_3N$, R_1COOH, R_1CONHR_2, R_1NH_2, $ArNH_2$ or ArSH; (b) Organosilanes, including compounds of the formula R_1SiCl_3, $R_1Si(O R_2)_3$, $(R_1COO)_2$, $R_1CH{=}CH_2$, R_1Li or R_1MgX; (c) pyrrole and pyrrole derivatives wherein R_1 is attached to one of the carbons of the pyrrole ring; (d) Compounds of the formula $R_1PO_3H_2$; (j) Unsaturated compounds including azoalkanes (R_3NNR_3) and isothiocyanates (R_3NCS); and (k) Proteins and peptides; wherein R_1 and R_2 each has the formula $X(CH_2)n$ and, if a compound is substituted with both R_1 and R_2, then R_1 and R_2 can be the same or different; R_3 has the formula $CH_3(CH_2)n$; n is 0-30; Ar is an aryl; X is $--CH_3$, $--CHCH_3$, $--COOH$, $--CO_2(CH_2)_mCH_3$, $--OH$, $--CH_2OH$, ethylene glycol, hexa(ethylene glycol), $--O(CH_2)_mCH_3$, $--NH_2$, $--NH(CH_2)_mNH_2$, halogen, glucose, maltose, fullerene C60, a nucleic acid (oligonucleotide, DNA, RNA, etc.), a protein (e.g., an antibody or enzyme) or a ligand; and m is 0-30.

3. The method of claim **1**, wherein said desired pattern comprises a dot.

4. The method of claim **1**, wherein said desired pattern comprises a line.

5. The method of claim **1**, wherein said desired pattern comprises a self-assembled monolayer.

6. The method of claim **1**, wherein said compound after deposition is a surface structure anchored to said target surface.

7. The method of claim **1**, wherein said compound is chemisorbed to the target surface upon discharge.

8. The method of claim **1**, wherein said sub-micrometer tip comprises a tip selected from the group consisting of an atomic force microscope tip, a scanning tunneling microscope tip, a near-field scanning optical microscope tip, a micro-pipette tip, an optical fiber tip, and a combination thereof.

9. The method as defined in claim **1**, wherein said pattern comprises at least a micrometer- or nanometer-scaled region of said functional material.

10. The method as defined in claim **1**, wherein said highly localized electric or magnetic field is substantially focused in a region smaller than 1 μm in size.

11. The method as defined in claim **1**, wherein said highly localized electric or magnetic field is generated by using a split-tip proximal probe.

12. The method as defined in claim **1**, wherein said highly localized electric or magnetic field is generated by using two sub-micrometer tips selected from the group consisting of an atomic force microscope tip, a scanning tunneling microscope tip, a near-field scanning optical microscope tip, a micro-pipette tip, an optical fiber tip, and a split-tip proximal probe.

13. The method as defined in claim **1**, wherein said target surface is preheated or precooled to a desired temperature.

14. The method as defined in claim **1,** wherein said target surface is exposed to a controlled atmosphere.

15. The method as defined in claim **14,** wherein said controlled atmosphere is selected from a group consisting of a vacuum, an inert gas, a reactive gas, and a combination of an inert gas and a reactive gas.

16. The method as defined in claim **1,** wherein said pattern-producing step comprises removing at least a portion of said liquid component by operating a device selected from the group consisting of a ventilation fan, a vacuum pump, a hot air blower, a heater, and a combination thereof.

17. The method as defined in claim **1,** wherein said functional material is selected from the group consisting of a piezo-electric material, a pyroelectric material, a ferro-electric material, a non-linear optic material, a conducting polymer, a ferromagnetic material, a ferri-magnetic material, an anti-ferromagnetic material, a liquid crystal material, and a combination thereof.

18. The method of claim **1**, wherein said sub-micrometer tip comprises a plurality of tips arranged in a desired geometric pattern.

19. The method of claim **1**, wherein said sub-micrometer tip comprises at least a split-tip proximal probe and at least one atomic force microscope tip, a scanning tunneling microscope tip, a near-field scanning optical microscope tip, or a micro-pipette tip.

20. A direct-write micro- or nano-lithography method for depositing a functional material onto a target surface, said method comprising:

(1) forming a precursor fluid to said functional material, said fluid containing a liquid component;

(2) providing a dispensing nozzle comprising a tip with a sub-micrometer orifice and a liquid chamber supplying said precursor fluid to said orifice;

(3) contacting said tip with said target surface so that the precursor fluid is delivered to said target surface so as to produce a desired pattern of said functional material in sub-micrometer dimensions; and

(4) during said pattern-producing step, subjecting the deposited material to a highly localized electric or magnetic field for attaining a preferred orientation in at least a portion of said functional material.

21. The method of claim **20**, wherein said highly localized electric or magnetic field is generated by using a split-tip proximal probe.

22. The method of claim **20**, wherein said dispensing nozzle comprises a plurality of tips arranged in a desired geometric pattern.

23. The method of claim **20**, wherein said dispensing nozzle comprises at least one tip with a sub-micrometer orifice and at least a split-tip proximal probe.

24. The method as defined in claim **20**, wherein said highly localized electric or magnetic field is generated by using two sub-micrometer tips selected from the group consisting of an atomic force microscope tip, a scanning tunneling microscope tip, a near-field scanning optical microscope tip, a micro-pipette tip, an optical fiber tip, and a split-tip proximal probe.

25. The method of claim **20**, wherein said liquid chamber is supplied with a pressure sufficient to produce a droplet of said fluid attached to said orifice.